

# NTMS4503N

## Power MOSFET

28 V, 14 A, N-Channel, SO-8

### Features

- Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- Low Gate Charge

### Applications

- DC/DC Converters
- Motor Drives
- Synchronous Rectifier – POL
- Buck Low-Side

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	28	V
Gate-to-Source Voltage – Continuous	$V_{GS}$	$\pm 20$	V
Drain Current	$I_D$	14	A
Continuous @ $T_A = 25^\circ\text{C}$ (Note 1)		12	
Continuous @ $T_A = 25^\circ\text{C}$ (Note 2)		9.0	
Continuous @ $T_A = 25^\circ\text{C}$ (Note 3)		40	
Single Pulse ( $t_p = 10 \mu\text{s}$ )	$I_{DM}$		
Total Power Dissipation	$P_D$	2.5	W
$T_A = 25^\circ\text{C}$ (Note 1)		1.66	
$T_A = 25^\circ\text{C}$ (Note 2)		0.93	
$T_A = 25^\circ\text{C}$ (Note 3)			
Operating and Storage Temperature	$T_J, T_{stg}$	$-55$ to $150$	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 30 \text{ V}$ , $V_{GS} = 10 \text{ V}$ , $I_L = 12.2 \text{ A}$ , $L = 1.0 \text{ mH}$ , $R_G = 25 \Omega$ )	$E_{AS}$	75	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

### THERMAL RESISTANCE RATINGS

Rating	Symbol	Value	Unit
Thermal Resistance	$R_{\theta JA}$	50	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)		75	
Junction-to-Ambient (Note 2)		135	
Junction-to-Ambient (Note 3)			

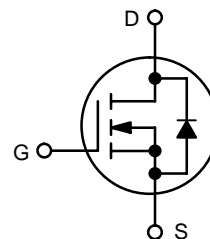
1. Surface-mounted on FR4 board using minimum recommended pad size (Cu area  $0.412 \text{ in}^2$ ),  $t < 10 \text{ s}$ .
2. Surface-mounted on FR4 board using 1" pad size (Cu area  $1.127 \text{ in}^2$ ) steady state.
3. Surface-mounted on FR4 board using minimum recommended pad size (Cu area  $0.412 \text{ in}^2$ ), steady state.



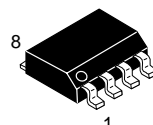
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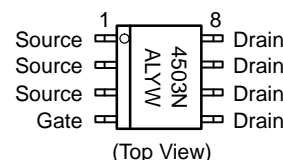
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX (Note 1)
28 V	7.0 m $\Omega$ @ 10 V	14 A
	8.8 m $\Omega$ @ 4.5 V	



### MARKING DIAGRAM/ PIN ASSIGNMENT



SO-8  
CASE 751  
STYLE 12



4503N = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week

### ORDERING INFORMATION

Device	Package	Shipping†
NTMS4503NR2	SO-8	2500/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NTMS4503N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		28	31	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	–		–	22	–	mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$	–	–	1.0	$\mu\text{A}$
			$T_J = 100^\circ\text{C}$	–	–	25	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$		–	–	$\pm 100$	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.0	–	2.0	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>	–	–	–5.0	–	mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 14 A	–	7.0	8.0	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	–	8.8	9.8	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 14 A	–	30	–	S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 16 V	–	2400	–	pF
Output Capacitance	C <sub>OSS</sub>		–	1000	–	
Reverse Transfer Capacitance	C <sub>RSS</sub>		–	375	–	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 16 V, I <sub>D</sub> = 10 A	–	23	–	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>		–	2.0	–	
Gate-to-Source Charge	Q <sub>GS</sub>		–	5.0	–	
Gate-to-Drain Charge	Q <sub>GD</sub>		–	12	–	

### SWITCHING CHARACTERISTICS, V<sub>GS</sub> = V (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 16 V, I <sub>D</sub> = 10 A, R <sub>G</sub> = 2.0 Ω	–	18.5	–	ns
Rise Time	t <sub>r</sub>		–	70	–	
Turn-Off Delay Time	t <sub>d(OFF)</sub>		–	21	–	
Fall Time	t <sub>f</sub>		–	23	–	

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 10 A	T <sub>J</sub> = 25°C	–	0.82	1.2	V
			T <sub>J</sub> = 125°C	–	0.65	–	
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /d t = 100 A/μs, I <sub>S</sub> = 14 A		–	48	–	ns
Charge Time	T <sub>a</sub>			–	23	–	
Discharge Time	T <sub>b</sub>			–	25	–	
Reverse Recovery Charge	Q <sub>RR</sub>			–	25	–	nC

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.  
5. Switching characteristics are independent of operating junction temperatures.

## TYPICAL PERFORMANCE CURVES

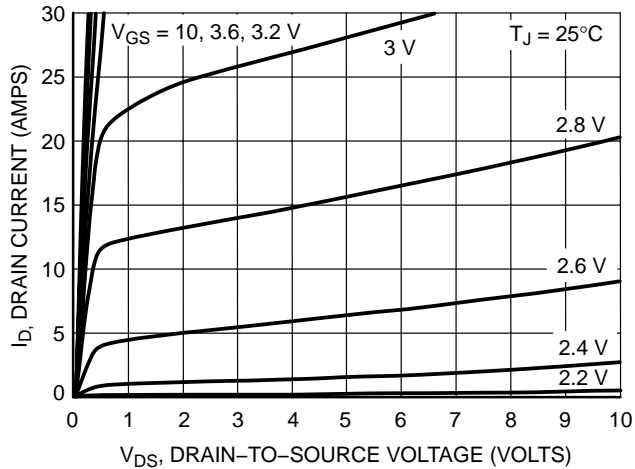


Figure 1. On-Region Characteristics

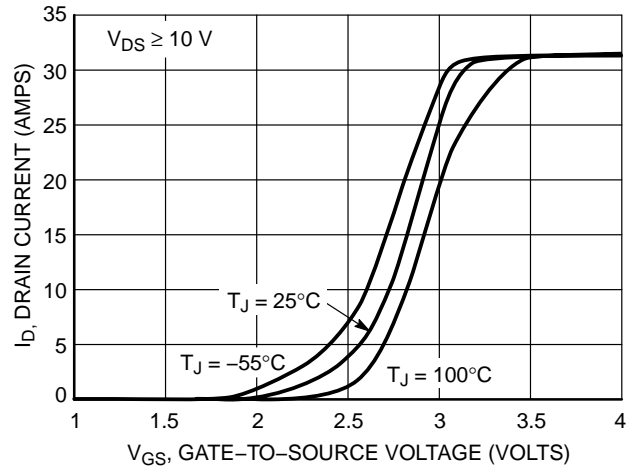


Figure 2. Transfer Characteristics

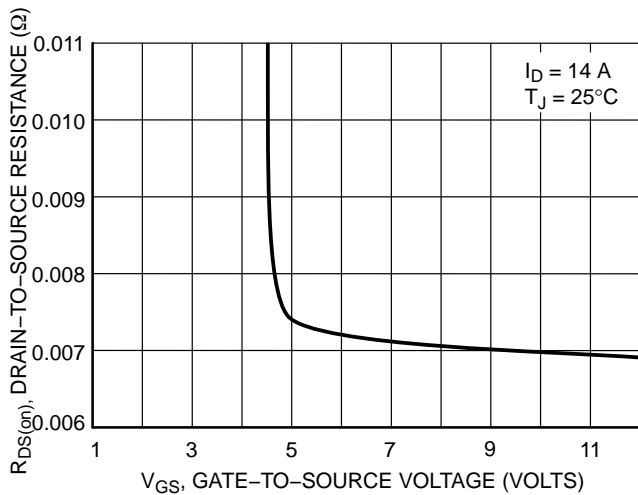


Figure 3. On-Resistance vs. Gate-to-Source Voltage

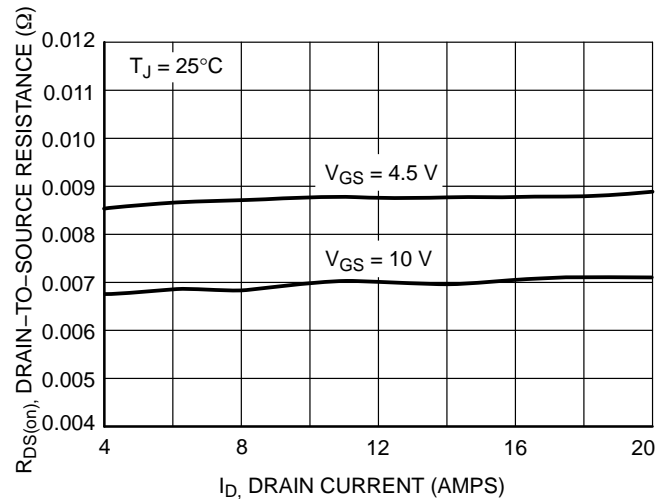


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

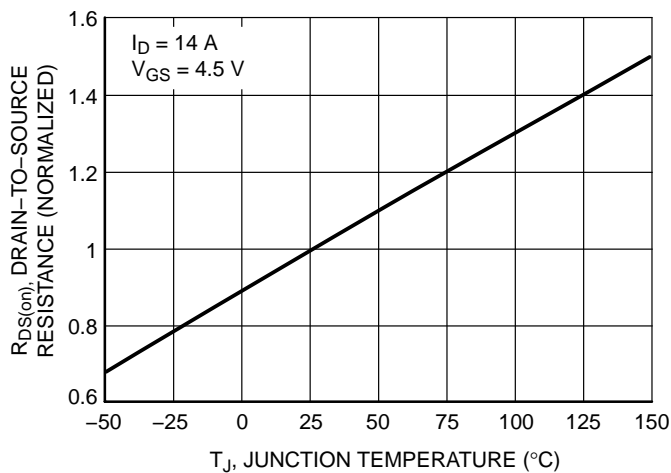


Figure 5. On-Resistance Variation with Temperature

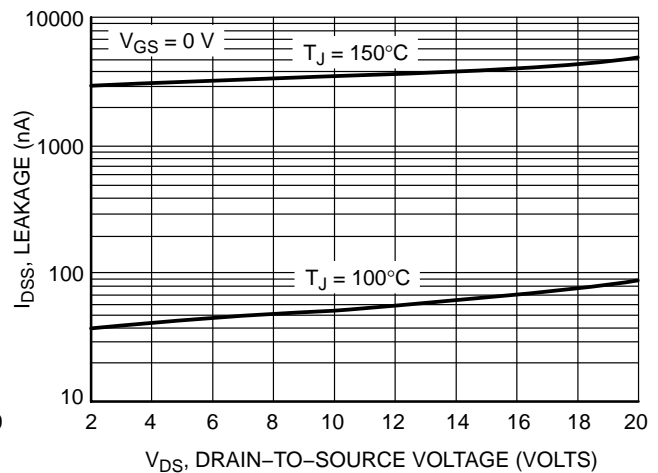


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

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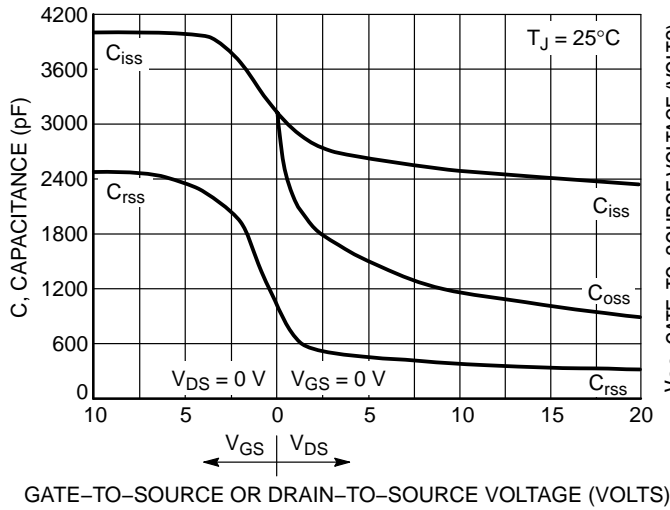


Figure 7. Capacitance Variation

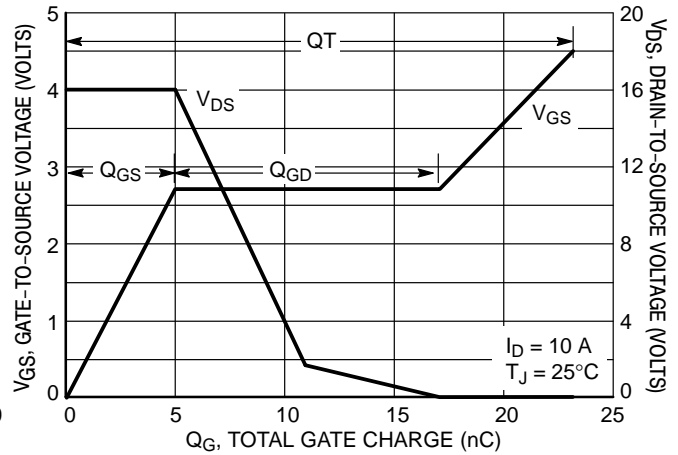


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

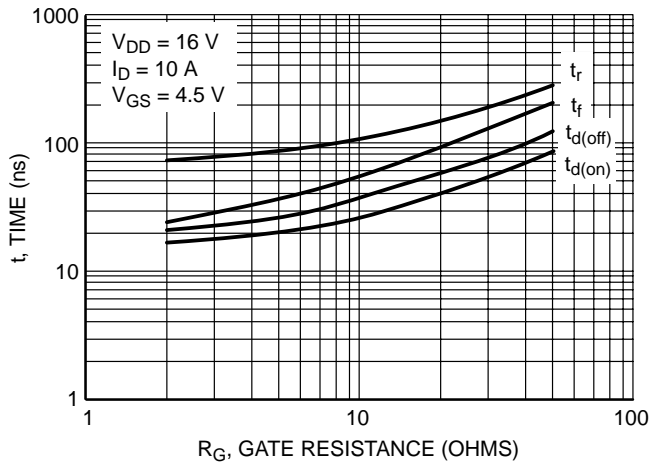


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

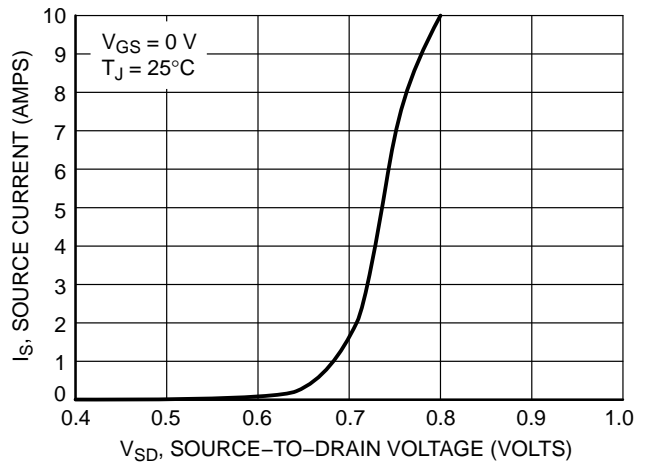


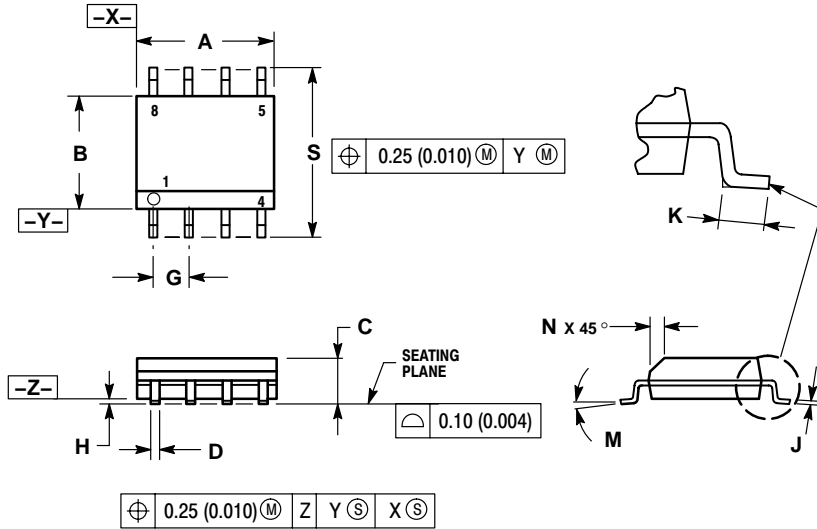
Figure 10. Diode Forward Voltage vs. Current

# NTMS4503N

## PACKAGE DIMENSIONS

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SO-8  
CASE 751-07  
ISSUE AA




### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

### STYLE 12:

- PIN 1: SOURCE  
2: SOURCE  
3: SOURCE  
4: GATE  
5: DRAIN  
6: DRAIN  
7: DRAIN  
8: DRAIN

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